LAST ONE!

Customer gets a copy

Return this to the floor

LAST ONE!

RFL 829G
Calibration & Test Proc.

MP-100955

MP MASTER
MA21685

B.F.L. 8249
Calibration : Test Proc.
MP-10095

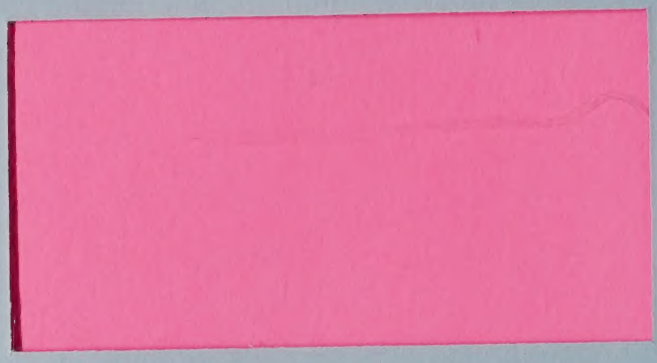
EE DEPT.

MODEL 829G

CALIBRATION and TEST PROCEDURE

MASTER COPY

RFL Industries, Inc.
Boonton, New Jersey, U.S.A.



MODEL 829G

CALIBRATION and TEST PROCEDURE

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_08117

MODEL 829G CALIBRATION STANDARD

A. Preliminary Check

Suggested Test Equipment

Oscilloscope – frequency response to 5 or 10 mHz
VOM – 20,000 ohms/volt dc 10,000 ohms/volt ac
Distortion Analyzer

1. Check to determine if Measurement Module is firmly seated in place.

2. Check to determine if straps on TB-1 are properly connected for the line voltage at which the Model 829G will be operated. TB-1 is a Jones barrier type connecting block located on the underside of the Model 829G chassis. Bottom cover of the unit must be removed for access to this strip. Refer to Model 829G schematic diagram for strapping connections.

3. Check for correct installation of shorting straps on Model 829G output terminals and for tightness of binding post screwdowns.

4. Remove protective cover from over resistors located on left rear of Model 829G. Connect VOM, set for 5 volt range across R15. With the VOM in dc mode, attach + lead to terminal with yellow lead attached and - VOM lead to other terminal of R15.

5. Connect oscilloscope to barrier type terminal strip on rear of Model 829G. High side of oscilloscope vertical input to strapped terminals marked 1 and 2; low side of oscilloscope input to strapped terminals marked 3 and 4.

6. Set Model 829G front panel controls as follows: (note – rotate all controls through all positions and check for ease of operation).
   a. Line ON-OFF switch to OFF.
   b. DISPLAY switch to READ.
   c. AMPLITUDE COARSE and MED/FINE controls full counter-clockwise. AMPLITUDE switch to NORMAL.
   d. RANGE selector full counter-clockwise.
   e. FUNCTION selector to VOLTS position.
   f. MODE selector to +DC.
   g. FREQUENCY selector to 400 Hz.
   h. READOUT switch to NORMAL.
   i. Safety interlock cover over output terminals in lowered position.

7. Plug Model 829G into line supply. Place LINE switch to ON and

observe for lighting of DPM readout and operation of cooling fan.

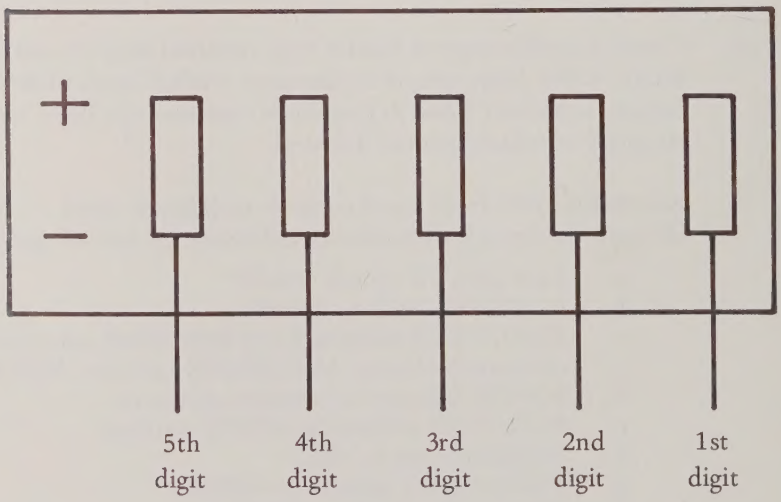
8. Observe idling current on VOM connected across R17. Indication should be +2 volts dc. Adjust the slider on R7, adjacent to R17, until 2 volt indication is obtained.

9. Set oscilloscope sweep range for 1 ms/cm and vertical sensitivity to 1 volt/cm.

10. Place AMPLITUDE switch to RUN-UP position and COARSE control to position 8. Reset indicator should be extinguished. If not, press RESET button or run COARSE control back to 0 and then return it to position 8.

11. Advance MED/FINE AMPLITUDE control clockwise while observing oscilloscope trace. Sine wave should appear with its amplitude increasing as MED/FINE control is advanced. Check for clean sine wave as control is advanced until Model 829 DPM indicates full-scale (i.e. 100.00). Oscilloscope should indicate approximately 4.5 volts p-p. Return MED/FINE control to zero while observing for proper sequential lighting of digits. Return AMPLITUDE COARSE control to 0 and AMPLITUDE switch to NORMAL.

    Reference to position of DPM digits in this procedure is denoted as shown below:



12. With FUNCTION selector in VOLTS position, rotate RANGE selector to each of its positions and check for correct location of decimal on DPM.

    a. 100 mV – decimal located between 2nd and 3rd digits.
    b. 1 volt – decimal located between 4th and 5th digits.
    c. 10 v. – decimal located between 3rd and 4th digits.
    d. 100 v. – decimal located between 2nd and 3rd digits.
    e. 1 kV – decimal located between 4th and 5th digits.
    f. Check to see that HIGH VOLTAGE indicator lights when RANGE selector is set at 100V and 1 kV positions and is extinguished at all other settings.

13. No decimal point should be evident when FUNCTION selector, is placed in either of the STANDARD RESISTOR positions.

14. Place FUNCTION selector to OHMS MEASURE position, 1K to 10M range. Rotate RANGE selector and check for correct location of decimal on DPM.

    a. 1K – decimal point between 4th and 5th digit.
    b. 10K – decimal between 3rd and 4th digit.
    c. 100K – decimal between 2nd and 3rd digit.
    d. 1M – decimal between 4th and 5th digit.
    e. 10M – decimal between 3rd and 4th digit.

15. Place FUNCTION selector to OHMS MEASURE position, 10 mohms to 100 ohms range. Rotate RANGE selector and check for correct location of decimal on DPM.

    a. 100 ohm – decimal between 2nd and 3rd digit.
    b. 10 ohm – decimal between 3rd and 4th digit.
    c. 1 ohm – decimal between 4th and 5th digit.
    d. 100 mohm – decimal between 2nd and 3rd digit.
    e. 10 mohm – decimal between 3rd and 4th digit.

16. Place FUNCTION selector to AMPERES position. Rotate RANGE selector and check for correct location of decimal on DPM.

    a. 100 μA – decimal between 2nd and 3rd digit.
    b. 1 mA – decimal between 4th and 5th digit.
    c. 10 mA – decimal between 3rd and 4th digit.
    d. 100 mA – decimal between 2nd and 3rd digit.
    e. 1 A – decimal between 4th and 5th digit.
    f. 10 A – decimal between 3rd and 4th digit.

17. Place FUNCTION selector to VOLTS position, RANGE selector to 100 mV, MED/FINE AMPLITUDE control counter-clockwise and COARSE AMPLITUDE control to 0.

    a. If RESET indicator is not lighted, rotate MODE selector to OFF and return it to +DC. RESET indicator should light. Lower plastic shield over output terminals. Advance COARSE control to position 3, press RESET button and RESET indicator should extinguish.

b. Raise safety interlock cover over output terminals; RESET indicator should light. Return COVER to lowered position, press RESET button – RESET indicator should extinguish.

c. Rotate RANGE selector through each of its positions. RESET indicator should light each time RANGE position is changed. Press RESET button to restore circuit (lamp will extinguish) between RANGE changes.

d. Rotate FUNCTION selector through each of its positions. RESET indicator should light each time selector position is changed. Pressing RESET button between changes of position should restore circuit.

e. Place FUNCTION selector to AMPERES. Rotate RANGE selector through each of its positions. RESET indicator should light each time position is changed. Pressing RESET button between changes should restore circuit.

f. With FUNCTION selector set at AMPERES, rotate MODE selector through each of its positions noting that RESET indicator lights after each change. Restore circuit after each change by pressing RESET button. NOTE: Reset circuit cannot be restored when MODE selector is in OFF position.

g. With COARSE AMPLITUDE control still at position 3, rotate RANGE selector one position so that RESET indicator lights. Lowering COARSE control to 0 position should reset circuit causing RESET indicator to extinguish.

18. Place FUNCTION selector to VOLTS position, MODE selector to +DC, MED/FINE AMPLITUDE control full clockwise and COARSE AMPLITUDE control to 0, RANGE selector to 100 mV. Check overload protective trip circuit by slowly advancing COARSE AMPLITUDE control clockwise until circuit trips, indicated by lighting of RESET indicator. Trip will occur at a level in excess of a 14000 reading of the DPM. Reset circuit by returning COARSE control to 0 and pressing RESET button. Perform this operation on each of the voltage ranges. DPM polarity should indicate +.

    CAUTION: high voltage will be present at the Model 829G output terminals at voltage RANGE settings of 100 volts and 1 kV.

19. Repeat step 18 but with MODE selector in -DC position. DPM polarity should indicate - .

20. Repeat steps 18 and 19 but with FUNCTION selector set to AMPERES position.

21. Repeat steps 18 and 20 but with MODE selector in AC position.

22. Check of output level and distortion of Model 829G internal oscillator.

    a. Connect distortion analyzer to OSCILLATOR OUTPUT connector on rear panel of Model 829G.
    b. Check output level with ac vtvm section of analyzer. Level should be 2 volts rms ±3%. Check level at the 50, 60 400 and 1000 Hz positions of Model 829G FREQUENCY selector.
    c. Check distortion at each setting of the Model 829G FREQUENCY selector. Typical values are shown below:

50 Hz	Nominal 0.05%;	max. 0.1%
60 Hz	Nominal 0.05%;	max. 0.1%
400 Hz	Nominal 0.03%;	max. 0.05%
1000 Hz	Nominal 0.03%;	max. 0.05%

B. Calibration

Required Test Equipment

Direct Voltage Ranges:

A direct voltage measurement system having a range from 10 mV to 1400 volts and an accuracy of ±(0.01% + 0.1 mV) or better.

Direct Current Ranges:

A direct current measurement system having a range from 10 μA to 14 amperes and an accuracy of ±(0.01% + 0.1 μA) or better.

NOTE

The systems referenced above should not have a burden rating in excess of the burden specified for the Model 829G.

A typical system could include a precisely calibrated differential voltmeter and a series of four-terminal shunts with the aggregate accuracy not exceeding that specified above.

Alternating Voltage Ranges:

An alternating voltage measurement system having a range from 10 mV to 1400 volts and an accuracy of ±(0.03% + 0.2mV) or better.

Alternating Current Ranges:

An alternating current measurement system having a range from 10 μA to 14 amperes and an accuracy of ±(0.03% + 0.2μA) or better.

NOTE

The alternating systems specified above should be calibrated in rms terms (rms sensing) and any burden presented should not exceed the burden ratings specified for the Model 829G.

A typical system could include a precisely calibrated differential voltmeter and a series of four-terminal shunts having flat frequency response to at least 1 kHz (i.e. ac to dc difference not exceeding ±0.01% from 50 to 1000 Hz).

Standard Resistance Ranges:

For values of 0.01, 0.1, 1, 10 and 100 ohms, a four-terminal bridge (Kelvin) is required. Accuracy should be on the order of ±0.02%.

For values of 1K, 10K, 100K, 1M and 10M, a 2-terminal (wheatstone) bridge having an accuracy of ±0.02% to 100K and ±0.03% to 10M may be used.

Ohms Measure Ranges:

For values up to 100 ohms, 4-terminal resistors having an accuracy of ± (0.02% + 50 μohms) are required.

Fixed values of 0.01, 0.1, 1, 10 and 100 ohms are recommended.

For the High Ohms Measurement ranges, fixed 2-terminal resistors having values of 1K, 10K, 100K, 1M and 10M are suggested. Accuracies of the resistors should be on the order of ±(0.02% + 0.1 ohm) for values up to and including 100K, ±(0.02%) for 1M and ±(0.1%) for 10M.

Where the Model 829G is to be used to measure voltage and current (i.e. Measurement Mode) it is suggested that the normal calibration be performed using the Model 829G as a supply (i.e. Calibration Mode) and spot checks be performed in the Measurement Mode, using appropriate dc and ac current and voltage sources having accuracies commensurate with the accuracies of the Voltage and Current measurement systems specified above. Care should be taken when operating at 400 and 1000 Hz in the Measurement Mode to determine that ground loops do not exist.

CAUTION

In the measurement mode, care should be taken to see the interconnecting of a high voltage supply to the Model 829G does not result in an 829G that has a "hot" chassis through misconnection of high and low emf leads. Extreme caution is recommended when operating in this mode.

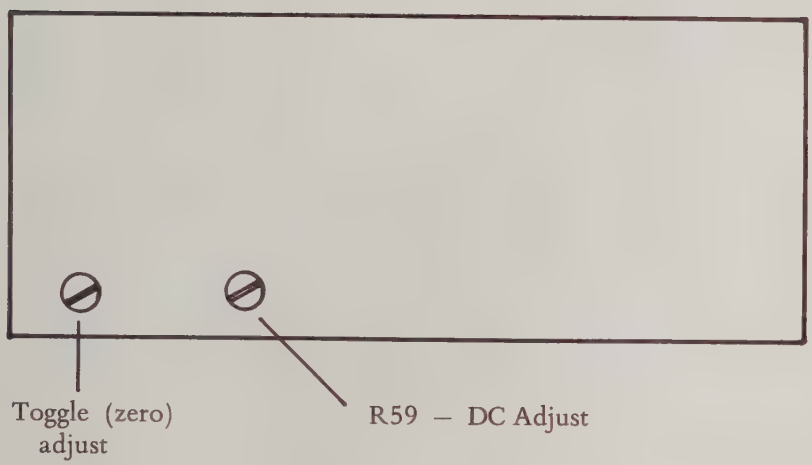
DPM Calibration:

Requires a standard cell having a calibrated value of ±0.01% or better. The cell recommended for installation in the Model 829G Measurement Module may be used or an external cell may be utilized if no cell is installed in the Module.

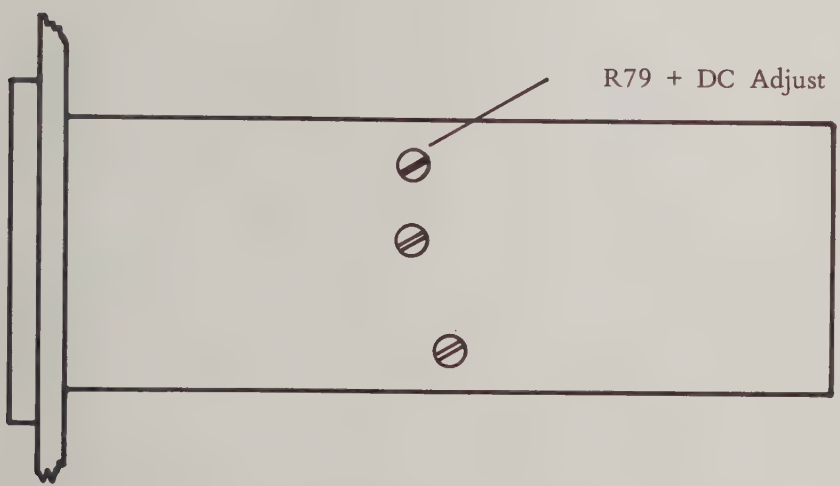
1. Model 829G DPM Calibration

   a. This involves setting of full-scale and zero (toggle) points of the meter.

   b. See sketch (below) for location of adjustment points.



Front of DPM with cover plate removed



Right side of DPM

Note: Allow approximately one-half hour warm-up prior to making any calibrations or adjustments.

c. Set DISPLAY selector to ZERO, RANGE selector to 1 Volt range, Mode Selector to +DC, FREQUENCY selector to 400 Hz, READOUT switch to NORMAL, AMPLITUDE switch to NORMAL and COARSE and MED/FINE controls fully-counter-clockwise. The toggle switches on the rear of the Measurement Module should be set to REVERSE and INTERNAL if an internal standard cell is used and EXTERNAL if an external cell is used.

d. Remove lower meter cover plate by pulling out from the center of its length. This exposes the Toggle and – Full Scale adjustments.

e. Adjust Toggle (zero) control on DPM until DPM polarity indicators critically switch back and forth between - and + . Meter should indicate .0000 ±3 digits.

f. Set DISPLAY switch to STD. CELL and adjust R59 until DPM indicates certified value of (-) standard cell. Place appropriate Toggle switch on rear of Measurement Module to NORMAL and observe for same DPM reading with a polarity indication of + . If readings are not the same within ± 1 digit, adjust R79 on side of DPM for appropriate reading. Recheck Toggle and REVERSE reading and readjust until DPM indicates value of standard cell plus or minus 1 digit in both NORMAL and REVERSE.

g. Place DISPLAY selector to OHMS CAL. position, and FUNCTION selector to HI OHMS MEASURE (1K - 10K - 100K - 1M). Connect a short circuit from High to Low output terminals on 829G. Adjust ohms calibrate potentiometer located in the furthest right hand hole of the three holes located under the DISPLAY selector until DPM indicates 1.0000. Remove short circuit from across Output terminals and place a 10 megohm resistor having the required accuracy across the Output. Set RANGE selector to 10M position and adjust center of the three pots located under the DISPLAY selector for a DPM reading of 10.000.

h. Set display selector to READ, FUNCTION selector to VOLTS and RANGE selector to 100 mV. Be certain all AMPLITUDE controls are full counter-clockwise. Adjust the pot behind the furthest left of the three holes under the DISPLAY selector for "toggling" of the + and - polarity indicators. Disregard any DPM reading.

2. Calibrate Voltage, Current and Resistance Ranges using operational procedure as set forth in the Model 829G Instruction Manual. Voltage calibrations may be made at a very low or high burden, depending on Measurement System used. Do not exceed rated burdens. If a low burden system is used, it is advisable to check calibration at or near full rated burden on a range of two by placing additional resistance in parallel with the measurement system. Again, do not exceed rated burden.

The series of four-terminal shunts used for current calibrations will generally operate at a sizable burden so generally no further burden tests are required.

The Model 829G circuitry is arranged so that voltage sensing is always at the Output terminals so losses in internal leads in the Model 829G do not introduce any errors. Care should be exercised, however, that leads from the Model 829G to the Measurement System are capable of interconnecting without introducing sizable emf drop with commensurate erroneous readings at the Measurement System.

Cables associated with the external Current Measurement System should be of sufficient cross-section so that excessive burdens are not introduced; this applies especially on the 10 ampere range.

In general, calibrations are made at full-scale, (DPM reading of 10000), half-scale and one-tenth of full-scale. See chart 1 for readings and tolerances.

CHART 1

Tolerance Limits

AC – Volts and Amperes

Range	Full-Scale	Limits 1/2 Scale	1/10 Scale
1 kV	1000.8 v 999.2	500.55 v 499.45	100.35 v 99.65
100 V	100.08 v 99.92	50.055 v 49.945	10.0355 v 9.9645
10 V	10.0085 v 9.9915	5.0065 v 4.9935	1.0040 v 0.9960
1 V	1.0013 v 0.9987	0.50105 v 0.49895	0.10085 v 0.09915
100 mV	100.58 mV 99.42	50.555 mV 49.445	10.535 mV 9.465
10 A	10.023 A 9.977	5.013 A 4.987	1.005A 0.995
1 A	1.0008 A 0.9992	0.50055 A 0.49945	0.10035 A 0.09965
100 mA	100.08 mA 99.92	50.055 mA 49.945	10.035 mA 9.965
10 mA	10.0085 mA 9.9915	5.0060 mA 4.9940	1.0040 mA 0.9960
1 mA	1.0013 mA 0.9987	0.50105 mA 0.49895	0.10085 mA 0.09915
100 μA	100.58 μA 99.42	50.555 μA 49.445	10.535 μA 9.465

CHART 2

Tolerance Limits

DC – Volts and Amperes

Range	Limits Full-Scale	1/2 Scale	1/10 Scale
1 kV	1000.5 V 999.5	500.35 V 499.65	100.23 V 99.77
100 V	100.05 V 99.95	50.035 V 49.965	10.023 V 9.977
10 V	10.0052 V 9.9948	5.0037 V 4.9963	1.0025 V 0.9975
1 V	1.0007 V 0.9993	0.50055 V 0.49945	0.10043 V 0.09957
100 mV	100.25 mV 99.75	50.235 mV 49.765	10.223 mV 9.777
10 A	10.012 A 9.988	5.007A 4.993	1.003A 0.997
1 A	1.0005 A 0.9995	0.50035 A 0.49965	0.10023 A 0.09977
100 mA	100.05 mA 99.95	50.035 mA 49.965	10.023 mA 9.977
10 mA	10.005 mA 9.995	5.0035 mA 4.9965	1.0023 mA 0.9977
1 mA	1.0007 mA 0.9993	0.50055 mA 0.49945	0.10043 mA 0.09957
100 μA	100.25 μA 99.75	50.235 μA 49.765	10.223 μA 9.777